X The Rods: Enhancing Interaction within Urban Setting Using Light and Sound Stimuli

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In this paper we explore engagement in the outdoor urban setting mediated through multi stimuli interventions. The focus is placed on cross modal perception of simultaneous or sequential audio and visual stimuli, such as light and sound, and its influence on people's engagement with such media. An empirical study was carried out in the real world setting where a responsive installation 'The Rods' was implemented using light and sound as feedback in two different ways (simultaneous and sequential) when touched by passers-by. We analyze the interactions and the data log and describe how often people interacted, what type of interactions they had and how long they lasted. Findings from the field study reveal that: (a) people respond to interaction using multisensory-stimuli feedback better than interaction based on single-stimulus feedback, (b) experiencing stimuli sequentially enhances interaction compared to simultaneous stimuli in the sense of number of interactions and their duration; moreover, stimulating the auditory sense before the visual during the first encounter attracts more people to interact compared to the other way round. Based on this, we propose possible ways to overcome this 'interaction Blindness' and provide 'windows of opportunity' for planners, urban designers, and interaction designers of urban interaction experiences.

X1 Introduction

Within the rapidly growing field of media and interactive art, many questions relating to people engagement are not very well understood, in particular within the urban space and how we experience mediated urban interactions. Previous research in neuroscience and psychology has suggested that experiencing multisensory stimuli affects the perception of each stimulus separately [Stein, 2012]. The reason for this is the way the human brain processes information gained from the environment - it optimizes data coming from surroundings by interfering, overlapping and overwriting perceived stimuli of different kinds in order to represent surroundings [Schacter et al., 2011]. Hence, combining multisensory stimuli within an interactive environment can affect how people engage with and through these environments, which is the focus of the research presented in this paper.

It is useful to consider this work against the background of a specific methodology: research 'in the wild', which might best be defined as the development of systems in real world settings; that is a process of moving away from the controlled environments of the research lab and the safety of prototype demonstrations that need only target research colleagues [Rogers, 2011]. Instead, the research is placed in-situ, throughout all iterations of design, implementation and observation.

The introduction of interactive installations within the real world setting may stimulate new behaviours, as well as creating new stages on which people can play out their engagements mediated by these media installations. What makes people engage with interactive urban media? How do people first notice and understand interactivity? And what happens when people are exposed to multi stimuli interventions? Will this stimulate different types of social interactions and perhaps influence the environment itself?

To address these questions, we present findings from an empirical study, which aims to investigate people's engagement with a multi stimuli intervention within the urban space: An interactive installation was developed specifically for this field study. The installation was placed in an outdoor setting over a three-week period. During this period, two experiments were performed using multisensory stimuli: a) light and sound stimuli were used separately and together as a feedback to touch b) light and sound stimuli were combined either in a sequential or simultaneous way.

In previous years many artists, theorists and scientists have been concerned with multisensory perception and experiences, both in the psychological field and within the field of interactive media. In this context, perception is defined as organization, identification, and interpretation of sensory information with the aim of representing and understanding the environment [Schacter, 2011], whereas experience is defined as the practical contact with an event that is being engaged with it [Oxford Dictionary, 2013].

Numerous psychological studies refer to cross-modal perception and focus on the question of dividing attention between auditory and visual perception and experiencing them simultaneously or sequentially. However, while this topic is intensively researched in the psychological field, not many researches focus on cross-modal perception within the field of urban prototyping and engagement. This paper addresses cross modal perception of simultaneous or sequential visual and auditory stimuli, such as light and sound, and its influence on people's engagement with interactive media in an outdoor public urban setting.

In the next section, we provide an overview of relevant multi-sensory studies within the field of psychology of perception, followed by related work from the interactive art. We then present our research methodology. We go on to outline and discuss our findings on people's perceptions of the interactive experience and conclude by outlining future work.

X2 Cross-Modal Perception

Cross modal perception of visual and auditory stimuli relates to properties of both light and sound. Although both are waves, it is important to note that sound and light convey very different information. While light is perceived as reflection of light waves off surfaces, sound as result of vibrations of an object depends both on its surface and internal structure [Graver, 2007]. Therefore, as they are perceived differently, they carry distinct information, which by cross-modal perception needs to be processed together involving interactions between two stimuli [Theeuwes et al., 2007].

A number of researchers suggest that continuous interaction and multisensory feedback are crucial for successful artifact. A study that deals with attention dividing between visual and auditory stimuli looked into the application of these findings to multisensory displays [Theeuwes et al., 2007]. The authors suggested that the usage of different modalities gives advantages in perceiving and understanding of information. Even though is it possible to process two modalities simultaneously, it should be noted that as soon as one of those modalities requires central attention, processing of other events is postponed. Here is important to note that this study was not carried out in the real world setting, and results might not be considered purely relevant.

Early studies regarding the question of cross-modal audio-visual perception are based on experiments performed on animals in order to assume how the human brain works. Findings indicated the existence of neurons with new shapes of response patterns to light-sound combinations, which differ from responses to single stimuli and their algebraic sum [Polyansky et al., 1975]. More recent, these studies are performed on people, but the exact processing of perceived information is still not familiar. It is worth mentioning another relevant set of studies that deal with the concept of dividing attention. Massaro proposes two defining criteria. First, the processing capacity of perceived stimuli is limited, and second, some of this processing capacity can be allocated to enhance processing. This means that experiencing two stimuli, such as light and sound, simultaneously can at the same time help its understanding, but dismiss parts of experiencing each stimulus separately. Additionally, he argues that divided attention (perceiving two stimuli simultaneously) decreases performance of people within these conditions. Results from experiments showed that performance of people is better in selective than in divided attention conditions, e.g. when experiencing both stimuli simultaneously [Massaro et al., 1977]. Considering all the above, particularly the study regarding divided audio-visual attention, it is expected that stimulating senses sequentially will enhance interactivity.

X3 Related Work in Media Arts and Architecture

There is a growing body of research, which aims to understand aspects that influence digitally mediated interactions in urban space. Little work has been carried out to understand how people experience and respond to interactive lighting and multi stimuli interactive experiences in everyday situations with the public space. Research within the area of media architecture and large screens have already made a broad contribution in understanding what happens in terms of interactions front of the screens and the potential role of the urban space [Fatah et al, 2008, Fischer et al, 2012]. Projects like

‘Responsive Urban Lighting’, for instance, explored awareness and engagement with the visual aspect of urban space interactions by involving citizens in generating light stories in urban settings using the actual city lighting. Findings indicated that people who observe interactions are the ones aware of the responsiveness rather than people who are involved due to the scale of light coverage [Skouboe et al., 2012]. On the other hand, the field study ‘Looking Glass’ addressed a smaller scale to explore the visual aspect of urban interactions using displays in shop windows. It investigated the problem of engagement with interactive installation using visual feedback from the movements of passers-by [Muller et al., 2012]. Findings indicated that passers-by often notice interactivity too late and have to walk back in order to interact (the landing effect), and, if somebody is already interacting, others begin interaction more easily (the honeypot effect) [Muller et al., 2012]. We note that these studies use single stimuli as feedback to interaction. We argue that it the landing effect might be prevented and interactivity made more obvious by including sound as a second stimuli, which would more directly attract the attention of people passing, causing them to understand the interaction before they pass the display. In regard to using sound in public space, it seems that the potential of sound is left out of urban environments [Franinovic and Serafin, 2013]. Based on the field study ‘Recycled Soundscape’, an installation that attracts passers-by to play by affecting and distorting the sounds captured from the environment, Franinovic suggests that the complexity of these works needs to be limited, especially in outdoor environments. Moreover, direct interface mapping is often preferred, such as gesture to sound [Franinovic and Visell, 2007]. Finally, the interactive installation, ‘Dune’, a grass-like interactive installation responsive to presence, unlike The Rods, when touched the response remains the same as if it is responding to body movement. This incites people to stop exploring and continue interaction in previously discovered manner [Daan Roosengaarde, 2013].

We have developed our prototype ‘The Rods’ and designed interactivity taken into account all the points mentioned above including the problem of cross modal perception of visual and auditory stimuli and its influence on engagement with interactive media in urban setting. We then implemented the installation in a public space and carried out a field study.

In the next section we describe two experiments, which were carried out using multisensory stimuli: a) light and sound stimuli were used separately and together as a feedback to touch b) light and sound stimuli were combined either in a sequential or simultaneous way.

X4 Methodology

In order to address the research questions, two experiments consisting of three test implementations were performed with the aim to provide data for analysis and comparison. The implementation was carried out over a three week period. Duration of each test implementations was two hours, 13:00-15:00 h, from Wednesday to Friday.

Both experiments capture people's engagement with interactive media and interaction initiation and as such focus on number of initiated interactions (installation being touched). To affirm the impact of multisensory stimuli on people's engagement, 1) light and sound stimuli were used, as feedback to touch, separately and together in the first experiment, 2) light and sound stimuli were combined into sequential and simultaneous multisensory stimuli. It is hypothesized that sequential multisensory stimuli will enhance interaction.

Data capture and evaluation was conducted through on-site video capture and observations by one researcher, combined with data logs by the installation of interactions through time-stamping each touch. When possible, the researcher carried out informal interview with passers-by to gather the impressions about the installation and interaction.

Both quantity and quality of interactions were evaluated. The quantity is measured by number of conceived interactions, while the quality is related to the type and duration of interactions.

It is important to note that this study is performed in outdoor conditions and, despite the efforts to keep the experiment environment similar through the period of study, many unpredictable external factors (outside the boundaries of the planned experiment such as the weather), can affect people's behavior.

Setting the scene: the location

The Arch Passage, University College London Campus was selected (Figure 1 and 2). This location is a narrow passage with high density of people flow, slightly enclosed and relatively dark, which is convenient for usage of light installation during day time. Moreover, different types of people pass-by – children, teenagers, young people, middle aged people and older people who usually head to or from lunch during this time of day.

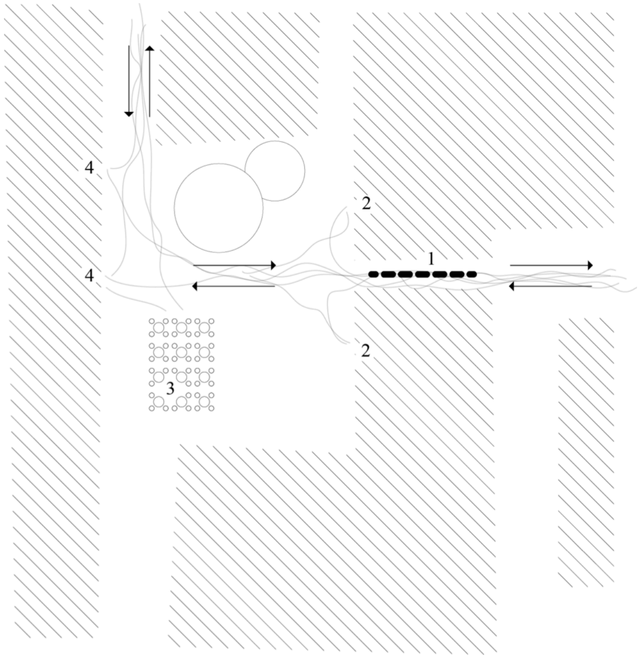

Figure 1: Map of the Arch passage, University College London Campus showing people flow and (1) position of the interactive installation in the Arch passage (2) stair entrance, (3) café and (4) entrance.

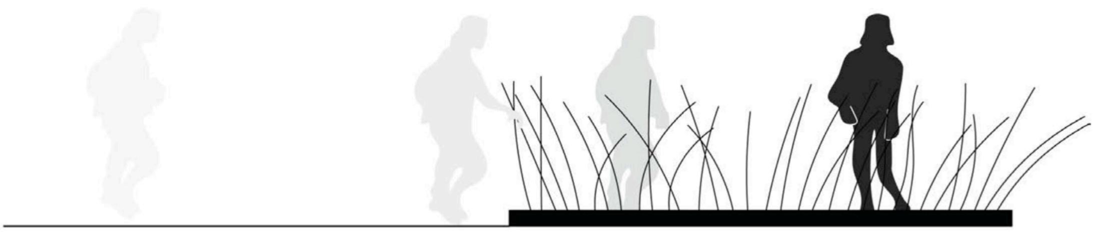

Figure 2: Interactive Installation 'The Rods'.

Setting the scene: the installation

The prototype is designed as a grass-like structure to invoke tactile interaction, more precisely brushing while passing. We conducted a pre study to examine the potential of acrylic rods for this research – their nature and their attractiveness for interaction. For this purpose we designed analog model, vertical rods positioned along horizontal line three meter long. Each rod is three millimeter thick and one meter long. They are transparent, have the ability to transmit light and flexibility to be bent. The experiment was performed in the Arch. During the 2-hour experiment, 59 passers-by, out of 200 people passing, interacted either by touching or brushing the prototype.

The analog model was digitalized by adding sensor, light (Addressable RGB LED strip allowing control of each light separately), controller (Arduino board) and power supply. Diodes of the light strip were positioned directly under acrylic rods to enable light transmission. When a rod is touched it bends slightly together with inner ring, which touches outer ring and closes circuit and the instructions are sent to the light and sound source.

We programed response of the installation within which we adapted their passive (not interacted with) state to each test implementation separately. Light and/or sound is activated when in passive state. When a rod is pressed response light and/or sound change to specifically assigned to this rod color and/or frequency sound. When the rod is released, light and/or sound fade out to original state. Duration of fading depends on duration of the rod being pressed. As each rod has different color and sound in active (interacted with) state, interaction creates playful experience. Both light and sound details, such as light color, sound frequency and volume were adjusted according to the scientific perception facts. We used blue and yellow as calming colours; the frequency of the sound is based on musical note system to generate pleasant and harmonized sound as suggested in one of the studies by Franinovic and Visell [2007]; and volume of the sound is between 80dB to 90dB slightly above the volume of speech and in the range which affects behavior of people in same manner [Cohen and Spacapan , 2008].

Visual, Auditory and Audio-Visual Stimuli (Experiment No.1)

Within the first experiment (Experiment no. 1), light and sound stimuli were used separately and together as feedback to touch. The aim is to affirm the impact of multisensory stimuli on people engagement with interactive media. Three implementations were performed.

In the first implementation (1.1), the prototype included only light stimuli as non-active state and as a feedback to touch. The initial colour of the rods is blue and each rod was separately responsive by changing colour to the assigned shade of yellow when touched. After releasing the rod, its colour fades out through different colours, and back to the initial colour - blue. Duration of fading out is related to the duration of holding the rod 'pressed'. Moreover, each rod is separately responsive. Hence, interacting with more than one rod produces combined light effects.

In the second implementation (1.2), the prototype included only sound stimuli as feedback to touch. The prototype produces sound of constant frequency as non-active state. It responds to touch with a sound changing its frequency to the one assigned to that specific rod. After the rod is released, sound slowly fades out to original sound playing frequencies between them. The duration of fading out of the sound is related to the duration of holding the rod pressed. To each rod a different frequency tone was assigned, from low frequency on one end of the prototype to high frequency on the other. Moreover, each rod is separately responsive. Hence, interacting with more than one rod produces combined frequency sound.

The third implementation (1.3) included both light and sound stimuli simultaneously as a feedback to touch of passers-by. Hence, interacting with the installation would stimulate both auditory and visual systems of participants and interacting with one or more rods keeps both sensory systems of the participant alerted – colourful response for visual senses and combined frequency tones for auditory sense. The prototype combines the behaviours from two previous implementations 1.1 and 1.2. In non-active state prototype lights up blue and produces sound of constant frequency. It responds to touch with a light changing from blue to assigned shade of yellow and sound changing its frequency to the one assigned to that specific rod. After releasing the rod, its colour fades out through different colours assigned to each rod separately, back to the initial colour – blue and sound slowly fades out to original sound playing frequencies between them. This creates mesmerizing light and sound effects leading people to stay interacting.

During the observations of interactions and the different types of interactions, certain categories of behaviour were identified together with their subcategories. The main categories are “looking at”, “briefly touching”, “brushing” and “interacting for a certain period of time” in different ways of touching, such as brushing, touching, banding and tapping. The first behaviours were identified as reaction, rather than interaction and all categories were present in all three test implementations but in very different percentages.

Analysis of the Results Experiment No.1

In regard to the tests using single stimuli – light or sound – analysis shows that more passers-by react when light stimulus is present within the installation. However, a multisensory test using two stimuli simultaneously shows that more people interact when two stimuli are combined within the installation.

The number of interactions within the test using simultaneous stimuli as feedback to touch (203 interactions out of total 1531 people passing by) is significantly higher than the number of interactions within single stimuli tests (76 interactions out of total 1492 within Visual test and 41 interactions out of 1550 within Auditory test) (Figure 3).

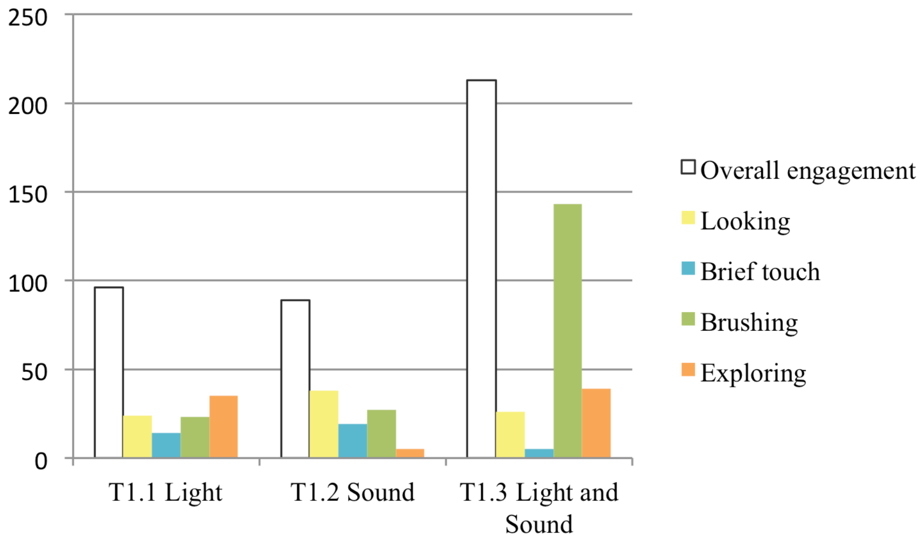

Figure 3: In this figure we compare results of three implementations of Experiment 1 – Test 1.1 using merely light stimuli; Test 1.2 using merely sound stimuli; Test 1.3 using both light and sound stimuli. The figure shows overall number of engagements of each test in white. Colour bars are analysis of overall engagement and the main types of engagement – looking, brief touch, brushing and exploring.

Compared to a 'single stimulus' test, number of people who look at the installation and do not interact decreased while number of people who interact increased during the Audio-Visual test. This signifies that people note and perceive interactivity better when both stimuli are present. In addition to this, during the Audio-Visual test, that is when stimulating both senses simultaneously, and compared to 'single stimulus' tests, the number of people looking at the prototype or briefly touching decreased while the number and duration of interactions increased. This points to the fact that feedback to touch using multisensory audio-visual stimuli provides more obvious interactive environment for passes-by than single sense stimulus feedback and attracts more people. As people understand interactivity they tend to react and interact more intensely – for instance, touching rather than looking, playing with the installation rather than briefly touching it. To summarise, when both stimuli are present within the installation, people feel more encouraged to engage compared to a single stimulus installation. In regard to single stimulus, using only visual feedback attracts more people than using only auditory feedback.

Feedback from people indicated that when the installation was stimulating only the auditory system, they were not certain if they should interact since there was no clear visual sign. In regard to the installation using light stimulus as feedback to touch, and due to fast walking, passers-by often did not notice the change of light after touching the installation. By the time passers-by decide to touch the installation it is no longer in their sight focus so the light is often unnoticed. However, people interacting with installation using both light and sound reported not giving attention or even stop noticing the light when the sound is present. The stimulus, which was initially identified as missing, is now reported as not being perceived. This is due to the way how human brain processes perceived data. What actually happens is that relating visual and auditory stimuli seems to enhance both light and sound experience reciprocally although it may seem to us that we do not give attention to one of

Figure 4: Visual Stimuli, Experiment 1, Test Implementation 1.1 - Landing Effect - Person brushing while passing; realizing interactivity after passing and turning around; walking back to the installation; interacting by brushing.

the stimuli. In this context, light seems to aid sound and sound aids light. (Figure 4)

Moreover, test including audio-visual stimuli caused more variety of behaviours compared to single stimulus test, and it initiated more conversations between strangers or friends (shaking in the rhythm of the sound using two hands wide open or close to each other, exploring from one side to another while banding, shaking or brushing strongly, changing the phone/bag/cigarette or similar from one hand to another in order to interact or even interacting using whatever they have in their hand such as shirt /bag /notebook) (Figure 5). A greater number of groups interacting and smiling appeared in the multisensory test. This caused an increase of the honeypot effect (Figure 6) [Brignull, H. and Rogers, Y. 2003].

In addition, if we take a look at the effect of the stimuli on the interaction duration, we see that longer interactions (1-2, 3-4, and 5 minutes) emerge in

Figure 5: Audio-Visual Stimuli, Experiment 1, Test Implementation 1.3 - Playing using “busy” hands - Person interacting using jacket;

Figure 6: Audio-Visual stimuli, Experiment1, Test implementation 1.3 - Cheerful groups, honeypot effect - Group of people causing honeypot effect; another group joins in interaction

greater number when light and sound stimuli are combined. While in test using only light stimulus, most people interacted for 10-20 seconds (23 passers-by out of 42), in the test using both stimuli the most people interacted for 1-2 minutes (20 passers-by out of 40) and 3-4 minutes (9 passers-by out of 40) (Figure 7) The period of established interaction and keeping people interested in it is beyond the scope of this paper.

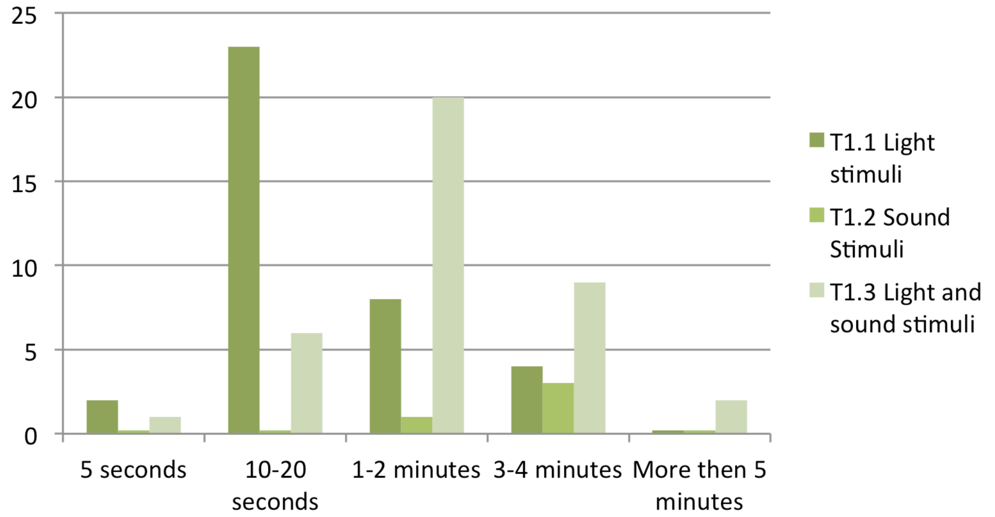

Figure 7: In this figure we compare the quality of interactions by observing the duration of interaction and how many people engage within three test implementations of Experiment 1 – Test 1.1 using merely light stimulus; Test 1.2 using merely sound stimulus; Test 1.3 using both light and sound stimuli.

Auditory and Visual Stimuli within Pre-interaction Period (Experiment No.2)

The second experiment is designed to explore the influence of simultaneous or sequential visual and auditory stimuli, of light and sound, on people engagement with interactive media in a public urban setting. The assumption is that stimulating senses sequentially will enhance interactivity, in a sense of initiating more interactions than other conditions.

Three implementations were performed, all of them including both light and sound within prototype. In order to alter simultaneous and sequential multisensory stimuli, sound level varied from approximately 80dB to 90dB. The aim was to have the lowest volume loud enough to be heard over the sounds present in the passage and to keep it within the range that affects human behavior in the same manner [Cohen and Spacapan, 2008]. The Volume is used to determine which stimulus will be experienced first based on its coverage radius and radius of light visibility. The sound loudness was adjusted according to light visibility radius, in a way to either have a smaller radius of coverage or greater radius of coverage or same radius of coverage as light – so that people approaching the installation experience first either light or sound or light and sound simultaneously. In the first implementation (2.1) sound radius was smaller than light radius - when approaching the installation people experience light before sound. Within the second implementation (2.2) the sound radius was bigger than light radius - when approaching the installation people experience sound before light. The prototype in the third implementation (2.3) included the same radius of light and sound - when approaching the installation people experience sound and light simultaneously.

Within all implementations, the prototype in non-active state was showing light and sound and as feedback to touch by passers-by. The initial colour of the rods was blue, slightly blinking, together with the sound frequency oscillating in the same way as the light. A tactile interaction triggers light and sound change. As long as the rod is pressed, its colour is yellow with a corresponding frequency sound. When the rod is released both light colour and sound slowly fade out back to the initial state. The duration of fade out is defined by the duration of rod being pressed. Each rod is separately responsive. Hence, interacting with more than one rod produces mesmerizing light and sound experience.

Analysis of Results Experiment No.2

Evaluation of the experiments results indicated that more people interact when stimuli are experienced sequentially. However experiencing sound before light seems more intriguing for people and causes more interactions than experiencing light stimulus before sound.

Number of people interacting when their senses are stimulated sequentially by light and sound stimuli during the first encounter with the installation (215 interactions out of 1449 within auditory as initial experience and 158 interactions out of 1521 within visual as initial experience) is significantly higher than number of people interacting when their senses are stimulated simultaneously (76 interactions out of 1535 passersby) (Figure 8). Hence, compared to the simultaneous stimuli test, number of interactions is doubled when experiencing visual stimuli before auditory and even tripled when experiencing auditory stimuli before visual. This indicates that stimulating visual and auditory senses sequentially at the first encounter with installation helps the interaction initiation. People find this experience more intriguing then experiencing both stimuli simultaneously and this seems to increase number of people who engage with the installation.

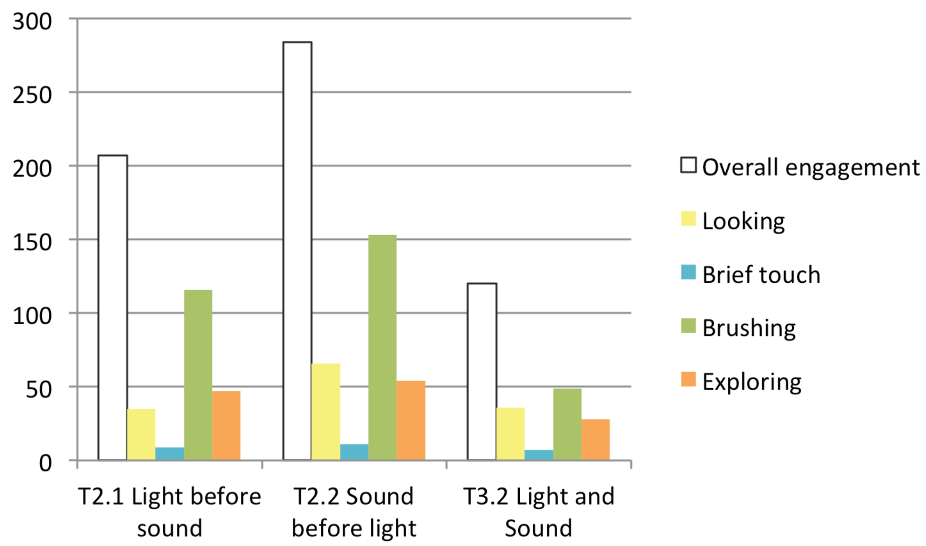

Figure 8: In this figure we compare results of three test implementations of Experiment 2 – Test 2.1 where people experience light before; Test 2.2 where people experience sound before light; Test 2.3 where people experience light and sound simultaneously as a first encounter with installation. Figure shows overall number of engagements of each test in white. Color bars are analysis of overall engagement and look into the main types of engagement – looking, brief touch, brushing and exploring

Moreover, as number of initialized interactions is higher when auditory system is stimulated before visual, it is clear that auditory experience has more influence on people than the visual primary experience. Feedback from passers-by outlined that experiencing sound before being able to spot the source of the sound made them wonder where the sound was coming from and this made them interact later.

In addition to this, if we take a look into the effect of the stimuli on the interaction duration, we see that longer interactions emerge in greater numbers when merely one of the stimuli is experienced during the first encounter. While when light is triggered before sound test, 20 passers-by engage for 1-2 minutes and 5 passers-by out of 51 engage for 3-4 minutes, and when sound is triggered before light, 29 passers-by engage for 1-2 minutes and 23 out of 53 for 3-4 minutes, whereas when light and sound are triggered simultaneously, only 14 people engage for 1-2 minutes and 2 out of 34 people for 3-4minutes. This shows that besides the observation that a single stimulus being more intriguing for interaction initiation, it also affects the interaction itself causing longer duration than when multisensory stimuli is experienced during the first encounter (Figure 9). The period of established interaction and keeping people interested in it is beyond the scope of this paper.

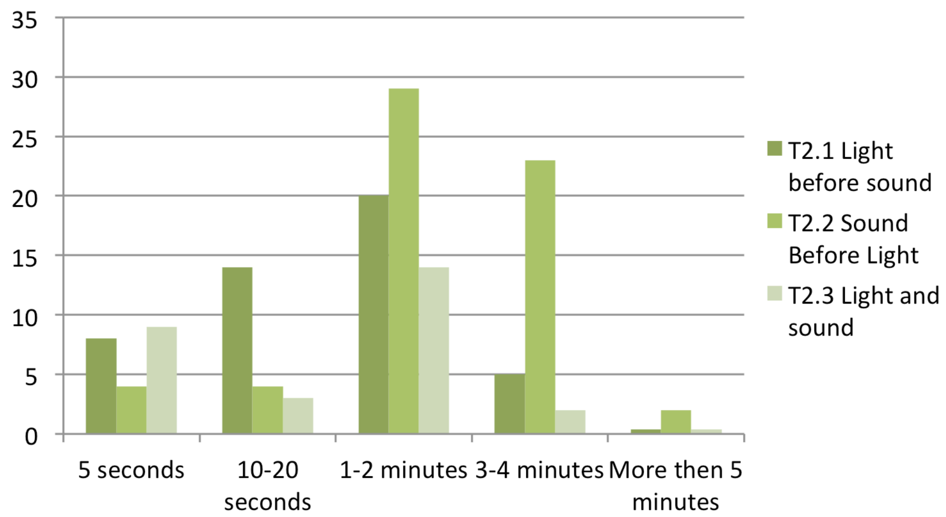

Figure 9: In this figure we compare the quality 'exploring' type of interaction by observing the duration of interaction and how many people engage in such a way within three test implementations of Experiment 1 – Test 2.1 where people experience light before; Test 2.2 where people experience sound before light; Test 2.3 where people experience light and sound simultaneously as a first encounter with installation.

By familiarizing with the perception of interactive environments it is possible to extract the rules and guidelines which could be further used for deigning and planning such environments.

X5 Discussion and Conclusion

Novel interactive digital technologies are transforming urban space and the way experience cities. The study presented in this paper focuses on cross modal perception of simultaneous or sequential visual and auditory stimuli, such as light and sound, and its influence on people's engagement with interactive media in outdoor public space. In more detail, this phenomenon is explored within pre-interaction period (the period before interaction initiation and the moment of interaction initiation) to determine how it can contribute to noticing interactivity, understanding it, and enhance interaction initiation.

We can now reflect on important aspects of urban engagement though sound and visual stimuli, contributing to a growing body of design knowledge in the field.

The analysis of the experiment's results points to three main findings, applicable to light and sound stimuli: (a) people understand interaction using multisensory-stimuli feedback better than interaction based on single-stimulus feedback; (b) experiencing stimuli sequentially enhances interaction in the sense of number of interactions; moreover, stimulating auditory sense before visual attracts more people to interact.

The number of interactions within the test using two stimuli combined as feedback to touch is significantly higher than the number of interactions within single stimulus tests. This demonstrates that people understand interaction using multisensory-stimuli feedback better and that they find it more attractive than interaction based on single-stimulus feedback. When comparing this results to the examples we mentioned in the related work section, such as the one using only sound feedback to interaction 'Transition Sounds' and the ones using only visual feedback to interaction: 'Looking Glass' or 'Responsive Lightning', we see in these examples that the passers-by do not notice interactivity, which represents a kind of interaction blindness [Ojala et al., 2012]. Here, based on our evaluation outcome, we suggest that interactivity is easier to realize if multisensory stimuli are used as feedback. Moreover, in regard to behaviours of people, we identified several new patterns that emerge when two stimuli are combined. In addition to this, the landing effect [Mueller et al., 2012], which refers to noticing interaction by passers-by too late and coming back to interact, was drastically decreased when auditory stimuli was included. Sound is a more direct stimulus, compared to the visual. It does not require the willful redirection of one's sensory system in order to be perceived. In this respect, it is easier to spot interactivity when the installation is using both sound and visual stimulus.

In regard to the simultaneous or sequential multisensory stimuli as feedback to interaction, passers-by interact more and with longer duration when stimuli is sequential. During the first encounter with the installation it is noted that experiencing sound before light seems more intriguing for people and causes more interactions than experiencing light stimuli before sound. These findings are supported by the psychological studies we referred to earlier in this paper, which explore divided-attention using audio and visual stimuli [Massaro and Warner, 1977] and the study, which refers to divided attention problem addressed to multisensory displays [Theeuwes et al. 2007]. Within these studies it was confirmed that visual recognition decreases when attention must be divided between auditory and visual stimuli and vice versa. When precise attention is required for one stimulus the processing of the other is postponed. The study presented in this paper addresses these facts within the field of interactive media in urban settings and its influence on engagement.

All of the findings we presented in the paper address a fragment of the question concerning engagement with interactive media within the urban settings. This is important as within the growing field of interactive media and art this represents critical and unfamiliar aspects in particular within the urban setting.

Fatah gen. Schieck [2009] calls out for the research community to target the planning system and urban planners and the development of appropriate strategies and ensure a sustainable implementation and integration of media screens in the build environment. Koorsgaard and brynskov (2014) argue that media architecture and urban interaction design not only should try to understand what happens around a given technology or design intervention, but also use it as an opportunity to understand and push larger topics related to digital policy, transparency, digitisation and how this changes and the role of the (digital) publics.

Multisensory defined interaction will cause larger number of interactions with different kinds of behaviour. We believe that these findings can feed into designing interactions and could be used when thinking about people's engagement during the design process of an audio-visual installation. In regard to interaction initiation experiencing sound before visual stimuli will enhance the number of interactions.

By being familiar with the behaviour of the people in interactive environments it is possible to extract rules and guidelines which could be further used for deigning and planning such environments. This could open up the new ways of thinking about the environment and the way we are planning and designing it. The focus of the design process would be on shaping social activities rather than the environment itself. For example, we could use sound and light for guidance of pedestrian traffic by shifting and navigating their attention. In the similar manner such interactive installations could be used to form attractors. The stimuli, merely light, merely sound or light and sound simultaneously could be used to control the intensity of attractor. Moreover, the new contacts emerging between strangers indicate that an interactive installation is a tool that connects people and hence could be used for adding on social activities in public space and hence increasing its quality. It is important to note that these rules should not be used strictly to shape the environment completely, but the space left for its emergent behavior will contribute itself. The detailed implication of such media in public environment is a subject of a future study.

It is necessary to note that these findings are the result of a 3 week field study and may vary if the study was performed 'in the wild' within different conditions. Moreover, as this is a field study is exposed to outdoor conditions, a great number of factors may influence the engagement and the results, despite the efforts to keep the experiment environment similar through the period of study. Additionally, the experiments were done in a single site and for the results to be confirmed exploration should be done within different types of environment and if possible using different types of the prototype. Besides that, in regard to evaluation based on number and duration of interactions, some facts were not taken into account, such as from what direction are people coming and what their specific experience is or weather interaction was initiated as consequence of honeypot effect or stimuli experience and the effect of experiencing the installation more than once by the same person when they use this route on a daily basis and how this might influence how they perceive the second or the third time they interact with the installation.

Finally, this study focuses on interaction initiation, i.e. pre-interaction stage – period of approaching installation and first touch but it gives slight insights into the interaction period – period of established interaction until leaving the installation. However, this topic remains open and it is to be explored as part of future research.

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The main contribution is a longitudinal in-the-wild study, which explores sustained behavior change and evaluates the impact of multiple feedback modalities.